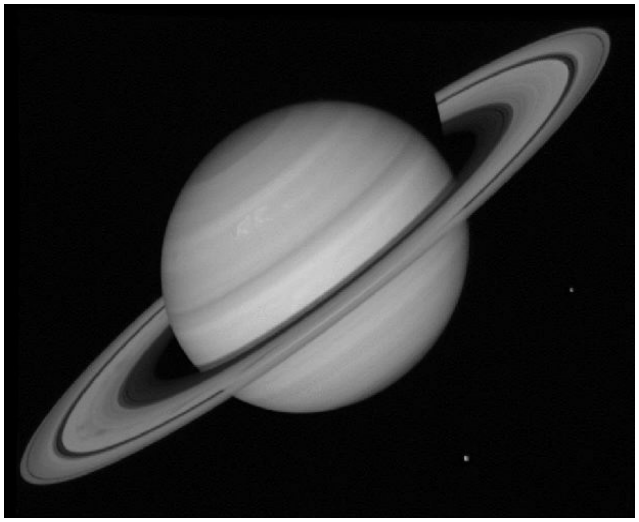
The Outer Planets

Teacher's Guide
Middle School



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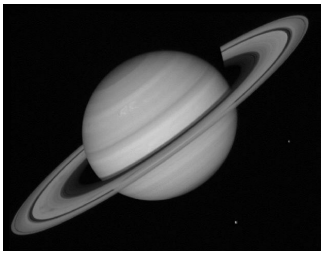

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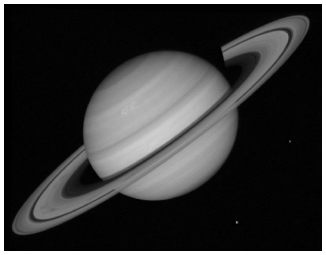

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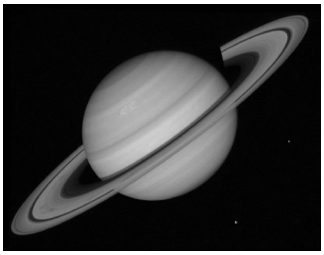

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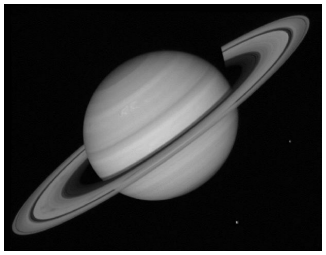


A Message from our Company ...

Dear Educator:

Thank you for your interest in the educational videos produced by the *Visual Learning Company.* We are a Vermont-based, family owned and operated business specializing in the production of quality educational science videos and materials.

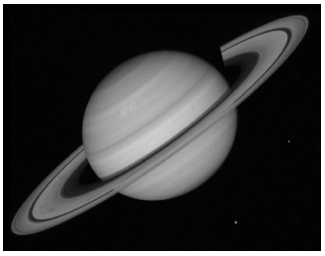
We have a long family tradition of education. Our grandmothers graduated from normal school in the 1920's to become teachers. Brian's mother was an elementary teacher and guidance counselor, and his father was a high school teacher and superintendent. This family tradition inspired Brian to become a science teacher, and to earn a Ph.D. in education, and lead Stephanie to work on science educational programs at NASA.

In developing this video, accompanying teacher's guide, and student activities, our goal is to provide educators with the highest quality materials, thus enabling students to be successful. In this era of more demanding standards and assessment requirements, supplementary materials need to be curricular and standards based - this is what we do!

Our videos and accompanying materials focus on the key concepts and vocabulary required by national and state standards and goals. It is our mission to help students meet these goals and standards, while experiencing the joy and thrill of science.

Sincerely,

Brian and Stephanie Jerome



National Standards Correlations

National Science Education Standards

(Content Standards: 5-8, National Academy of Sciences, c. 1996)

Earth and Space - Content Standard D:

As a result of their activities in grades 5-8, all students should understand that:

- The earth is the third planet from the sun in a system that includes the moon, the sun, eight other planets and their moons, and smaller objects, such as asteroids and comets. The sun, an average star, is the central and largest body in the solar system.

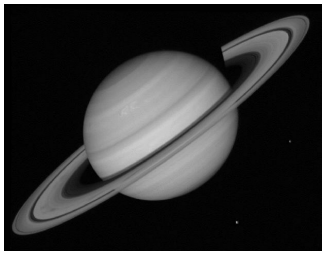
Benchmarks for Science Literacy

(Project 2061 - AAAS, c. 1993)

The Physical Setting - Processes that Shape the Earth (4A)

By the end of the 8th grade, students should know that:

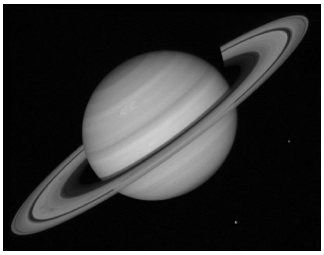
- Nine planets of very different size, composition, and surface features move around the sun in nearly circular orbits. Some planets have a great variety of moons and even flat rings of rock and ice particles orbiting around them. Some of these planets and moons show evidence of geologic activity. The earth is orbited by one moon, many artificial satellites, and debris.
- The sun is a medium-sized star located near the edge of a disk-shaped galaxy of stars, part of which can be seen as a glowing band of light that spans the sky on a very clear night. The universe contains many billions of galaxies, and each galaxy contains many billions of stars. To the naked eye, even the closest of these galaxies is no more than a dim, fuzzy spot.



Student Learning Objectives

Upon viewing the video and completing the enclosed student activities, students should be able to do the following:

- Describe some of the characteristics of our nearest star, the sun;
- Compare and contrast features of the planets Jupiter, Saturn, Uranus, Neptune, and Pluto;
- Describe our solar system as consisting of one sun, nine planets and their moons, and any other matter orbiting the sun;
- Explain how the force of gravity keeps the planets in orbit around the sun and moons in orbit around the planets;
- Explain that our solar system is part of a large galaxy called the Milky Way Galaxy;
- Describe what an asteroid is made of and where the asteroid belt is found in the solar system;
- Describe the unique rings found around the outer planets; and
- Compare some of the differences between the inner planets and the outer planets.



Assessment

Preliminary Test:

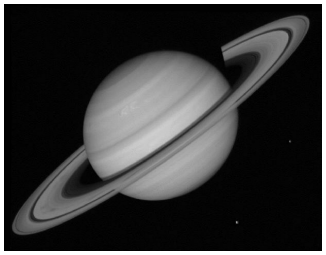
The Preliminary Test, provided in the Student Masters section, is an assessment tool designed to gain an understanding of student preexisting knowledge. It can also be used as a benchmark upon which to assess student progress based on the objectives stated on the previous pages.

Video Review:

The Video Review, provided in the Student Masters section, can be used as an assessment tool or as a student activity. There are two main parts. The first part contains questions titled "You Decide" that can be answered during the video. The second series of ten questions consists of a video quiz to be answered at the conclusion of the video.

Post-Test:

The Post-Test, provided in the Student Masters section, can be utilized as an assessment tool following student completion of the video and student activities. The results of the Post-Test can be compared against the results of the Preliminary Test to assess student progress.



Introducing the Video

Ask the students to list the five planets that are considered to be the "outer planets." Tell the students that the outer planets are separated from the inner planets by the asteroid belt which consists of hundreds of thousands of ice and rock fragments. Explain that the largest planets in our solar system are found beyond the asteroid belt and that most of these planets are gaseous and some even have rings circling them.

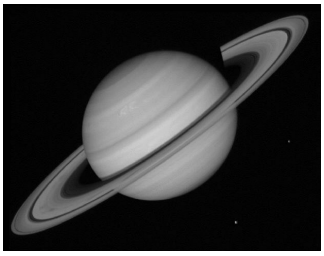
Write down the name of each of the five outer planets on the black board. Next ask students to list some characteristics of each of these planets. Write their answers under the name of the appropriate planet. Tell students to pay close attention to the video so they can add to the list following the program.

Video Viewing Suggestions

The Student Master "Video Review" is provided for distribution to students. You may choose to have your students complete this Master while viewing the program or to do so upon its conclusion.

The program is approximately 20-minutes in length and includes a ten-question video quiz. Answers are not provided to the Video Quiz on the video, but are included in this teacher's guide. You may choose to grade student quizzes as an assessment tool or to review the answers in class.

The video is content-rich with numerous vocabulary words. For this reason you may want to periodically stop the video to review and discuss new terminology and concepts.



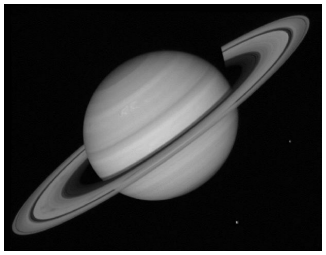
Student Assessments And Activities

Assessment Masters:

- Preliminary Test
- Video Review
- Post-Test

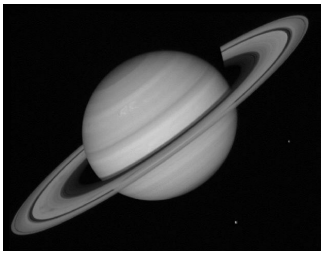
Student Activity Masters:

- Making a Scale Model
- Calculating Your Weight on the Outer Planets
- Planet by Numbers
- Vocabulary of *The Outer Planets*



Video Script: *The Outer Planets*

1. For thousands of years people have looked up at the night sky pondering the limits of our solar system.
2. Perhaps you too, have looked up at the evening stars and planets, and wondered what they might look like up close.
3. During the past 40 years astronomers and scientists have developed powerful telescopes to better observe the stars and planets, . . .
4. . . . And they've also launched spacecrafts to get a more detailed view of the planets.
5. We've learned amazing things about the planets in our solar system– things we never knew before.
6. During the next few minute we're going to explore some of the characteristics of our solar system.
7. We're going to take a brief look at the planets close to the sun – also called the "inner planets" . . .
8. . . . And take a more in depth view of the planets farther from the sun – called the "outer planets".
9. But first let's review some of the properties of the sun . . .
10. . . . , and the four planets closest to it.
11. **Graphic Transition – The Sun and Our Solar System**
12. Perhaps you've looked up at the night sky and noticed a thin . . .
13. . . . band of white haze. This is our galaxy – a collection of stars, planets, and other matter.
14. The name of this haze is the Milky Way Galaxy.
15. It's a huge galaxy of which our solar system is a very small part.
16. Our solar system consists of the Sun, nine planets and their moons, as well as other structures travelling around the sun.
17. The sun is the central point around which all of the planets in our solar system travel.
18. Without the sun, life as we know it would not exist on Earth.
19. The sun is huge. In fact, nearly one million planets the size of the earth could fit inside the sun.
20. The sun produces enormous amounts of heat, light, and radiant energy.
21. **You Decide!**
22. What process is responsible for this energy?
23. Nuclear fusion is the process by which the sun converts matter into energy.
24. The primary source of fuel in the sun is hydrogen.
25. Besides producing energy, the sun is also extremely important in that it serves as the gravitational anchor . . .
26. . . . around which all of the planets in our solar system revolve.
27. Let's take a brief look at how the planets travel through space.



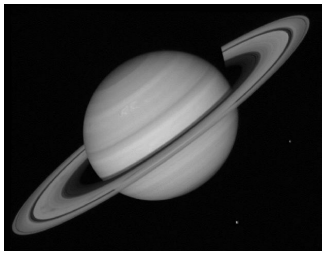
Script (cont.)

28. Graphic Transition – The Moving Planets

29. For centuries people thought the sun traveled around the earth.
30. But throughout the ages many different astronomers proved that earth . . .
31. . . . along with the other 8 planets in our solar system actually orbit around the sun.
32. An orbit is the path an object travels when going around another object in space.
33. We also know that the planets travel in an ellipse around the sun.
34. An ellipse is oval in shape, somewhat similar to the shape of this egg.
35. The time it takes a planet to make a complete trip around the sun is called its period of revolution.
36. It takes earth about 365 days to make a complete revolution around the sun.
37. It takes other planets different amounts of time to make a complete revolution.
38. For example, it takes the planet Pluto about 248 years to revolve around the sun!
39. As the planets revolve around the sun they're also spinning on their axes. This process is called rotation.
40. **You Decide!**
41. How long does it take Earth to rotate on its axis?
42. It takes about 24 hours or one day for earth to rotate on its axis.
43. Rotation is responsible for day and night on Earth.

44. Graphic Transition – The Inner Planets

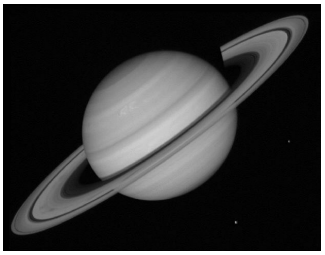
45. Earth is a very unique planet in our solar system in that it's the only planet that we know of which supports life.
46. Scientists believe there are a number of reasons for this, but perhaps the most important one is our distance from the sun.
47. Earth's distance from the sun, along with its unique atmosphere allow moderate temperature fluctuations.
48. Relatively moderate temperature swings are favorable to the plants and animals, which thrive here.
49. The planet Mercury on the other hand, which is the closest planet to the sun experiences huge temperature swings.
50. Temperature there ranges from minus 180 degrees Celsius to as high as 427 degrees Celsius. That is hot enough to melt this piece of lead.
51. Mercury, like the other inner planets is a dense planet.
52. The second planet from the sun is Venus.
53. This too is a relatively dense planet, and its surface is dominated by volcanic features, and craters.
54. The thick atmosphere of Venus acts like a blanket keeping the planet very warm.
55. As we stated, Earth is the third planet from the Sun. Earth too is relatively dense.
56. **You Decide!**
57. What covers 70% of earth's surface?
58. Liquid water, primarily in earth's oceans covers about 70% of earth's surface. This large expanse of water helps moderate the earth's overall temperature, and also



Script (cont.)

provides a home to thousands of different kinds of living things.

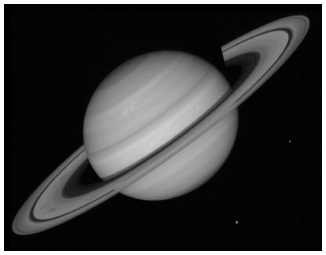
59. Mars, the fourth planet from the Sun may once have had abundant liquid water flowing on its surface. You can tell that by these ancient water channels.
60. But today, its rocky surface reveals a planet dominated by red soils high in iron oxide.
61. Its atmosphere is thin, and fails to retain much heat from the sun.
62. Now let's begin traveling through the asteroid belt toward the outer planets.
63. **Graphic Transition – The Asteroid Belt**
64. Many scientists estimate that about 65 million years ago a large piece of matter from space called an asteroid . . .
65. . . . collided with earth.
66. The asteroid struck earth with such velocity and force that it's believed to have . . .
67. . . . altered earth's weather, eventually leading to the extinction of the dinosaurs and many other life forms.
68. This large crater in Arizona is an example of a place where an asteroid collided with the earth's surface.
69. That collision created a crater that is about 1.2 kilometers or about 3/4 mile across!
70. Where do asteroids come from?
71. Our solar system has many rock and metallic objects that orbit the sun.
72. They're too small to be considered planets and are referred to as asteroids.
73. The vast majority of asteroids are found in the region between Mars and Jupiter . . .
74. . . . which scientists refer to as the Asteroid Belt.
75. Asteroids are believed to be pieces of matter that remain after the creation of the solar system.
76. Astronomers have numbered and named over 4000 asteroids.
77. . . . and thousands others remain unnamed.
78. **Graphic Transition - Jupiter**
79. In March 1972, a rocket containing a spacecraft lifted off in the first endeavor to visit .
80. . . . the outer regions of our solar system.
81. Pioneer 10 was the first spacecraft to travel through the asteroid belt and to travel to the larger planet of Jupiter – the fifth planet from the sun.
82. In December of 1973, over one and a half years after launch from earth the space craft...
83. . . . returned the first close-up images of Jupiter.
84. During the 1970s three other spacecraft were also launched and directed toward Jupiter.
85. These spacecraft found Jupiter to be a whirling ball of liquid hydrogen and helium.
86. The planet is referred to as a gas giant
87. . . .and is the largest planet in our solar system.
88. **You Decide!**
89. What is the Giant Red Spot on Jupiter?
90. The Giant Red Spot is a swirling storm, which has existed for hundreds and perhaps



Script (cont.)

thousands of years.

91. Sixteen satellites or moons orbit Jupiter.
92. This one called Io possesses active volcanoes.
93. **Graphic Transition – Saturn**
94. One of the most strikingly beautiful planets in our solar system is Saturn
95. It's the sixth planet from the sun.
96. The most noted feature of this planet are its rings.
97. Like Jupiter, Saturn is a giant, gaseous, planet.
98. Next to Jupiter, it's the second largest planet in the solar system.
99. Saturn is made mostly of hydrogen and helium, and…
100. …It is the least dense planet. It could actually float on water.
101. The rings of Saturn have fascinated scientists for hundreds of years.
102. The ring system of Saturn extends outward hundreds of thousands of kilometers. This is similar to the distance between the earth and its moon.
103. **You Decide!**
104. What are the rings made of?
105. The rings are made up primarily of particles of ice, ranging in size from a mere speck to 100 kilometers in diameter.
106. Saturn has more moons than any other planet in the solar system.
107. At last count there were 18 moons.
108. Titan is the largest of Saturn's moons.
109. It has an unusual atmosphere that in many ways is similar to Earth's early atmosphere.
110. This leads scientists to believe that life may one day develop on Titan.
111. **Graphic Transition – Uranus**
112. Uranus is twice as far from the sun as its nearest neighbor Saturn.
113. Until the Voyager 2 spacecraft visited the planet in January, 1986, little was known about it.
114. After leaving Saturn, it took Voyager 2 about four and a half years to travel over 700 million kilometers to reach Uranus.
115. Uranus, the third largest planet, and seventh planet from the sun, takes 84 years to make a complete revolution around the sun.
116. It's an unusual planet, in that it appears to lie on its side.
117. Its axis is tilted at an angle of about 90 degrees.
118. The atmosphere of Uranus consists mainly of hydrogen . . .
119. …and small amounts of methane, which gives it, its blue color.
120. Like Saturn, Uranus is also surrounded by rings, but the rings of Uranus are dark colored.
121. **Graphic Transition – Neptune and Pluto**
122. It wasn't until the mid 1800s that one of the more distant planets – Neptune was discovered.



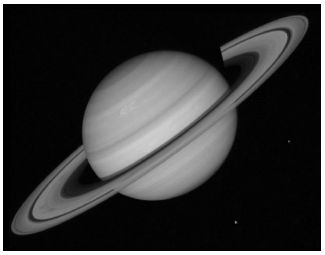
Script (cont.)

123. Neptune is a blue-green color and has a thick cloud cover.
124. It's very cold due to its great distance from the sun.
125. The surface of Neptune possibly consists of an ocean of water and liquid methane.
126. Eight moons orbit Neptune of which the icy moon Triton is the largest.
127. Between 1979 and 1999, Neptune was the farthest planet from the sun,
128. But now the planet Pluto is the most distant planet from the sun.
129. Pluto is the smallest planet in the solar system, a little larger than the earth's moon.
130. The frozen planet, Pluto, is made of different ices, primarily methane.
131. Pluto does have a moon, called Charon, which is very close to the planet.
132. Graphic Transition – Summing Up
133. During the past few minutes we have reviewed some of the characteristics of the inner planets including those of Mercury the closest planet to the sun . . .
134. . . . Venus, the second planet from the sun . . .
135. . . . our planet Earth, the third planet from the sun . . .
136. . . . and Mars, the fourth planet from the sun.
137. We also studied the way planets rotate on their axis . . .
138. . . and revolve around the sun in elliptical orbits.
139. We took a more in depth look at the asteroid belt found between Mars and Jupiter.
140. And then we studied the characteristics of some of the gas giants including Jupiter, the fifth planet from the sun. . .
141. . . . Saturn, the sixth planet. . .
142. . . . and Uranus, the seventh planet from the sun.
143. We also took a brief look at the two outermost planets – Neptune
144. and Pluto.
145. So the next time you look up at the night sky . . .
146. . . . or look at an image of one of the planets . . .
147. ... think about some of the fascinating things we discussed during the past few minutes.
148. You might just think about our solar system a little differently.

Video Quiz

Fill in the correct word to complete the sentence. Good luck and let's get started.

1. The planets revolve around the _____.
2. A planet _____ on its axis.
3. Planets have an orbit the shape of an _____.
4. _____ is the second planet from the sun.
5. The Asteroid Belt is located between ____ and Jupiter.
6. Jupiter is referred to as a _____ giant.
7. Saturn's rings are made primarily of _____.
8. The ____ of Uranus is tilted at 90 degrees.
9. _____ is the eighth planet from the sun.
10. A _____ is an object which orbits around a planet.



Answers to Student Assessments

Preliminary Test

1. Milky Way
2. nine
3. radiant
4. orbit
5. axis
6. water
7. asteroids
8. Jupiter
9. moons
10. Pluto
11. false
12. true
13. true
14. true
15. false
16. true
17. false
18. false
19. true
20. true

Video Review

You Decide:

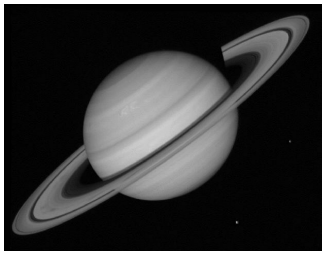
1. Nuclear fusion is the process by which the sun converts matter into energy.
2. It takes 24 hours for the earth to rotate on its axis.
3. Liquid water covers 70% of Earth's surface.
4. The Giant Red Spot on Jupiter is a swirling storm.
5. The rings are made of particles of ice.

Video Quiz:

1. sun
2. rotates
3. egg, ellipse
4. Venus
5. Mars
6. gas
7. ice
8. axis
9. Neptune
10. moon

Post Test

1. true
2. false
3. false
4. false
5. false
6. true
7. true
8. true
9. true
10. true
11. radiant
12. axis
13. moons
14. water
15. Jupiter
16. Milky Way
17. orbit
18. Pluto
19. nine
20. asteroids



Answers to Student Activities

Making a Scale Model

Conclusion: After completing the activity, students should have gained an appreciation for the expansiveness of space, and how small the planets are relative to the space between them.

Calculating your Weight on the Outer Planets

Answers will vary depending upon subject's weight.
Sample answers for 100 lb. student:
Jupiter- 254 lbs.
Saturn- 93 lbs.
Uranus- 80 lbs.
Neptune- 120 lbs.

1. Jupiter has the greatest gravitational pull, and therefore you would weigh the most on Jupiter.
2. You would weigh the least on Uranus.
3. Jupiter is an extremely large planet and therefore has a large gravitational pull.

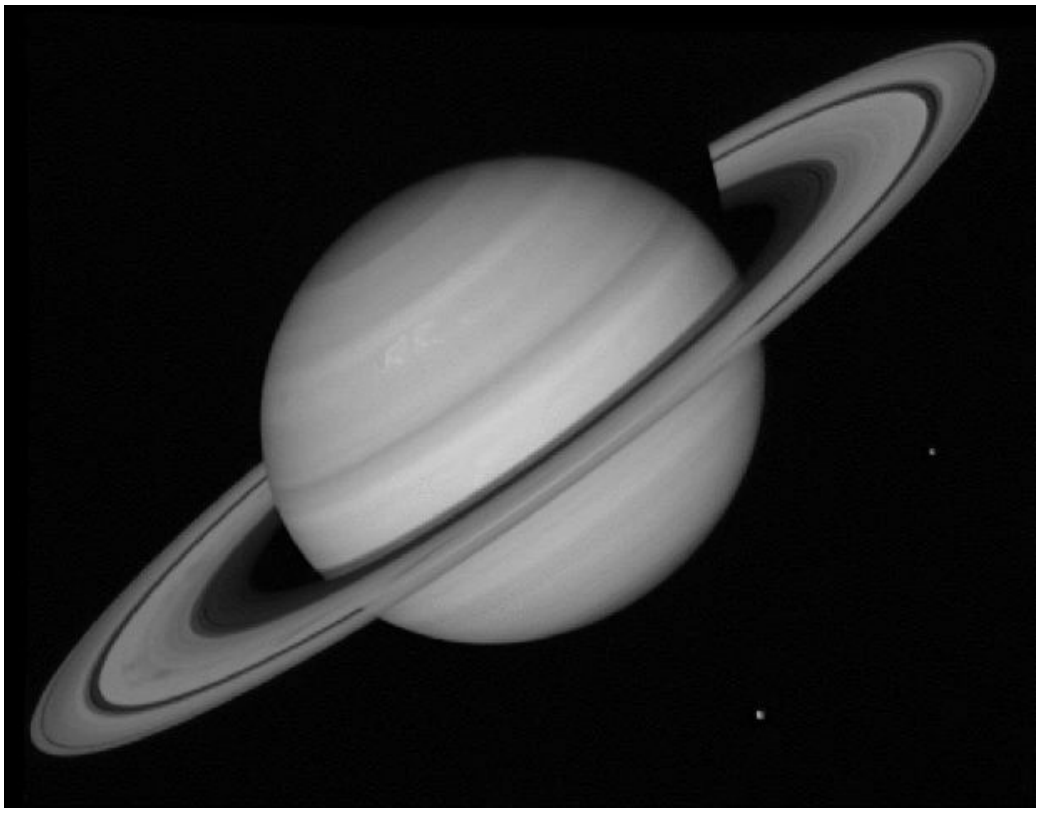
Planet by Numbers

The image produced in the grid should resemble the planet Saturn

Vocabulary:

1. i, Pluto
2. c, nuclear fusion
3. a, inner planets
4. f, Jupiter
5. j, Neptune
6. e, asteroid belt
7. b, outer planets
8. h, Uranus
9. d, hydrogen
10. g, Saturn

Assessment and Student Activity Masters



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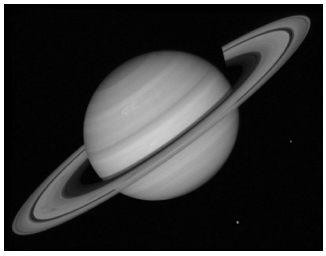


Preliminary Test

Directions: Fill in the blank with the correct word. A list of possible answers is provided at the bottom of the page.

1. Our solar system is part of the _____ _____ galaxy.

2. There are _____ planets in our solar system.

3. The sun produces enormous amounts of _____ energy.

4. Earth travels around the sun in an _____.

5. Earth's day is based on the time it takes for Earth to rotate on its _____.

6. _____ on Earth helps moderate the overall temperature.

7. Rock and metallic objects that orbit the sun are called _____.

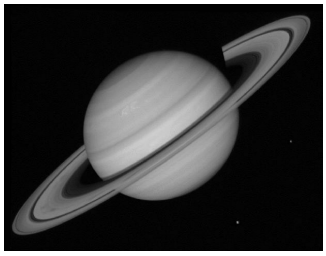
8. The largest planet in our solar system is _____.

9. Saturn has 18 _____.

10. _____ is the planet farthest from the sun.

axis	ice
nine	asteroids
Saturn	Jupiter
water	Milky Way
orbit	Pluto
moons	radiant

Name_____

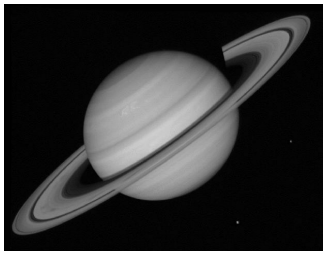


Preliminary Test

Directions: Decide whether the answer is True (T) or False (F).

11. The sun revolves around the earth.	T	F
12. Our solar system is part of a larger galaxy.	T	F
13. An ellipse is oval in shape.	T	F
14. The rotation of Earth is responsible for day and night.	T	F
15. Fifty percent of Earth's surface is covered with water.	T	F
16. The asteroid belt is found between Mars and Jupiter.	T	F
17. The Giant Red Spot is a storm found on Saturn.	T	F
18. The second to last planet from the sun is Titan.	T	F
19. Pluto is believed to be the smallest planet.	T	F
20. Similar to Saturn, Uranus is encircled by rings.	T	F

Name_____



Video Review

Directions: During the course of the program, answer the "You Decide" questions as they are presented in the video. Answer the Video Quiz questions at the end of the video.

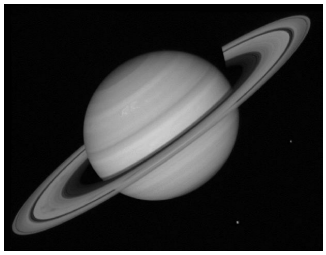
You Decide:

1. What process is responsible for this energy? Answer _____
2. How long does it take Earth to rotate on its axis? Answer _____
3. What covers 70% of Earth's surface? Answer _____
4. What is the Giant Red Spot on Jupiter? Answer _____
5. What are the rings made of? Answer _____

Video Quiz:

1. The planets revolve around the _____.
2. A planet _____ on its axis.
3. Planets have an orbit the shape of an _____.
4. _____ is the second planet from the sun.
5. The Astroid Belt is located between _____ and Jupiter.
6. Jupiter is referred to as a _____ giant.
7. Saturn's rings are made primarily of _____.
8. The _____ of Uranus is tilted at 90 degrees.
9. _____ is the eighth planet from the sun.
10. A _____ is an object which orbits around a planet.

Name_____

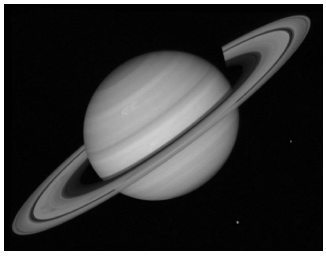


Post Test

Directions: Decide whether the answer is True (T) or False (F).

1. An ellipse is oval in shape. T F
2. The Giant Red Spot is a storm found on Saturn. T F
3. Fifty percent of Earth's surface is covered with water. T F
4. The second to last planet from the sun is Titan. T F
5. The sun revolves around the Earth. T F
6. Similar to Saturn, Uranus is surrounded by rings. T F
7. Pluto is believed to be the smallest planet. T F
8. Our solar system is part of a larger galaxy. T F
9. The asteroid belt is found between Mars and Jupiter. T F
10 . The rotation of Earth is responsible for day and night. T F

Name_____



Post Test

Directions: Fill in the blank with the correct word. Choose from the list of possible answers at the bottom of the page.

11. The sun produces enormous amounts of _____ energy.

12. Earth's day is based on the time it takes for Earth to rotate on its _____.

13. Saturn has 18 _____.

14. _____ found on Earth helps moderate the overall temperature.

15. The largest planet in our solar system is _____.

16. Our solar system is part of the _____ _____ galaxy.

17. Earth travels around the sun in an _____.

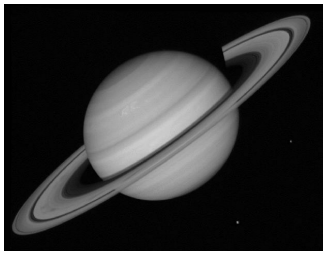
18. _____ is the planet farthest from the sun.

19. There are _____ planets in our solar system.

20. Rock and metallic objects that orbit the sun are called _____.

axis	ice
nine	asteroids
Saturn	Jupiter
water	Milky Way
orbit	Pluto
moons	radiant

Name_____



Making a Scale Model

Objective: In this activity, students will compose a scale model of our solar system to gain a better understanding of how small the planets are compared to the vast expanse of outer space.

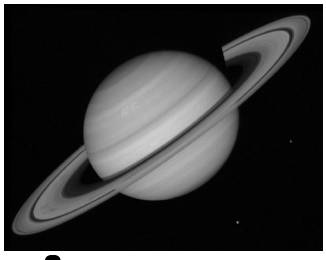
Background: On a clear night, away from city or town lights, you can look up into the night sky and see thousands of bright stars. At certain times of the year it is even possible to spot some of the planets in our solar system. For example, when Venus appears in the night sky, the planet glows with a reddish-colored tint. But how far away are these stars and planets? From Earth's surface it is difficult to grasp just how much space is out there!

Our solar system is composed of one star (the sun), nine planets, and their moons. In our solar system, planets are spread apart by millions of kilometers! Even though it seems that Earth and the other eight planets are quite large, they take up a relatively small amount of space in our solar system. In this activity you will make a scale model of our solar system and see just how small Earth is and how far it is away from the planets.

Materials:
1 sheet of yellow construction paper
9 index cards
colored pencils
2 meter sticks
large outdoor area

Procedure: In this scale model, one centimeter will represent 500,000 kilometers.
1. Cut a sphere about 2.8 cm in diameter out of the yellow construction paper. This will be used to represent the sun.
2. Study chart A on the following page. This chart includes the actual size of each planet in kilometers as well as the scale size of each planet measured in millimeters.
3. On each index card draw a dot representing a planet using the scale size measurement. Notice that some planets will be represented by a very tiny dot while others will be somewhat bigger. Estimate as best you can about what size dot should represent the smaller planets.
4. With your teacher, take your finished index cards outside to the designated area. Place the sun at one end on a post.
5. Refer to chart B for the scale distances necessary to spread the planets at the correct distance apart. To do this you can either measure from the sun or from the previous planet. Both measurements are given in the chart.

Name_____



Making a Scale Model

Chart A:

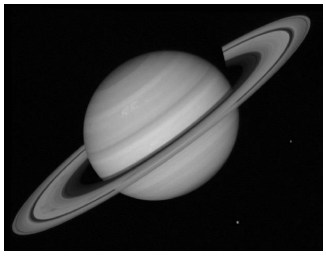
Planet	Actual Size Diameter (km)	Approximate Scale Size Diameter (mm)
Mercury	4,900	.10
Venus	12,100	.24
Earth	12,800	.25
Mars	6,800	.14
Jupiter	143,000	2.9
Saturn	120,000	2.4
Uranus	51,800	1.0
Neptune	49,500	.99
Pluto	2,300	.046

Chart B:

Planet	Actual Distance from Sun	Model Distance from Sun	Distance from Previous Planet
Mercury	58 million km	1 meter, 16 cm	NA
Venus	108 million km	2 meters, 16 cm	100 cm
Earth	150 million km	3 meters	84 cm
Mars	228 million km	4 meters, 56 cm	1 meter, 56 cm
Jupiter	778 million km	15, meters, 56 cm	11 meters
Saturn	1,430 million km	28 meters, 60 cm	13 meters, 4 cm
Uranus	2,870 million km	57 meters, 40 cm	28 meters, 80 cm
Neptune	4,500 million km	90 meters	32 meters, 60 cm
Pluto	5,900 million km	118 meters	28 meters

Conclusion: After finishing the activity, what have you learned with regard to planet size and distances between planets?

Name_____



Calculating Your Weight on the Outer Planets

Objective: In this activity, students will calculate what their weight would be on four of the outer planets.

Background: Weight is a property produced by a force called **gravity**. On Earth, your weight is the gravitational pull acting on your body. All planets have a gravitational pull that is unique to that planet. For instance, Jupiter's gravitational pull is more than twice the amount as Earth's. In the table below, calculate your weight according to the gravitational pull data by multiplying your weight by the planet's gravitational pull.

Planet	Gravitational Pull	Weight x Gravitational Pull
Jupiter	**2.54**	
Saturn	**.93**	
Uranus	**.8**	
Neptune	**1.2**	

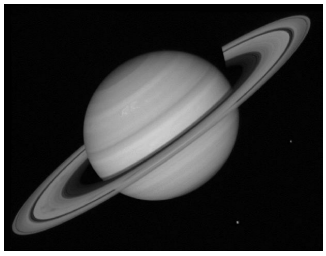
Questions:

1) On what planet is your weight the greatest?

2) On what planet is you weight the least?

3) Why is there such a large gravity pull on Jupiter?

Name_____



Planet by Numbers

Objective: In this activity, students will use a model to demonstrate how image producing spacecraft create images of objects in space.

Background: The Hubble Space Telescope orbits far above Earth. This telescope has provided astronomers the opportunity to see into unknown areas of space. The Hubble Space Telescope has become the electronic eyes of today's astronomers!

The Hubble Space Telescope acts in much the same way as a camera, but instead of using film it utilizes devices which detect and collect light. The telescope captures light from objects in space on a grid of pixels where each pixel represents a certain shade of color. The completed grid is transmitted to computers on Earth in the form of a picture. The telescope in space works cooperatively with computers on Earth to create the images viewed in outer space.

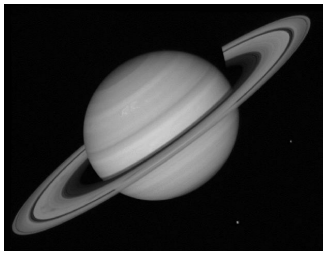
In this activity, you and a partner will simulate the communication process that goes on between the telescope and computer.

Materials:
Transparent grid of page 29
Pencil
Scissors

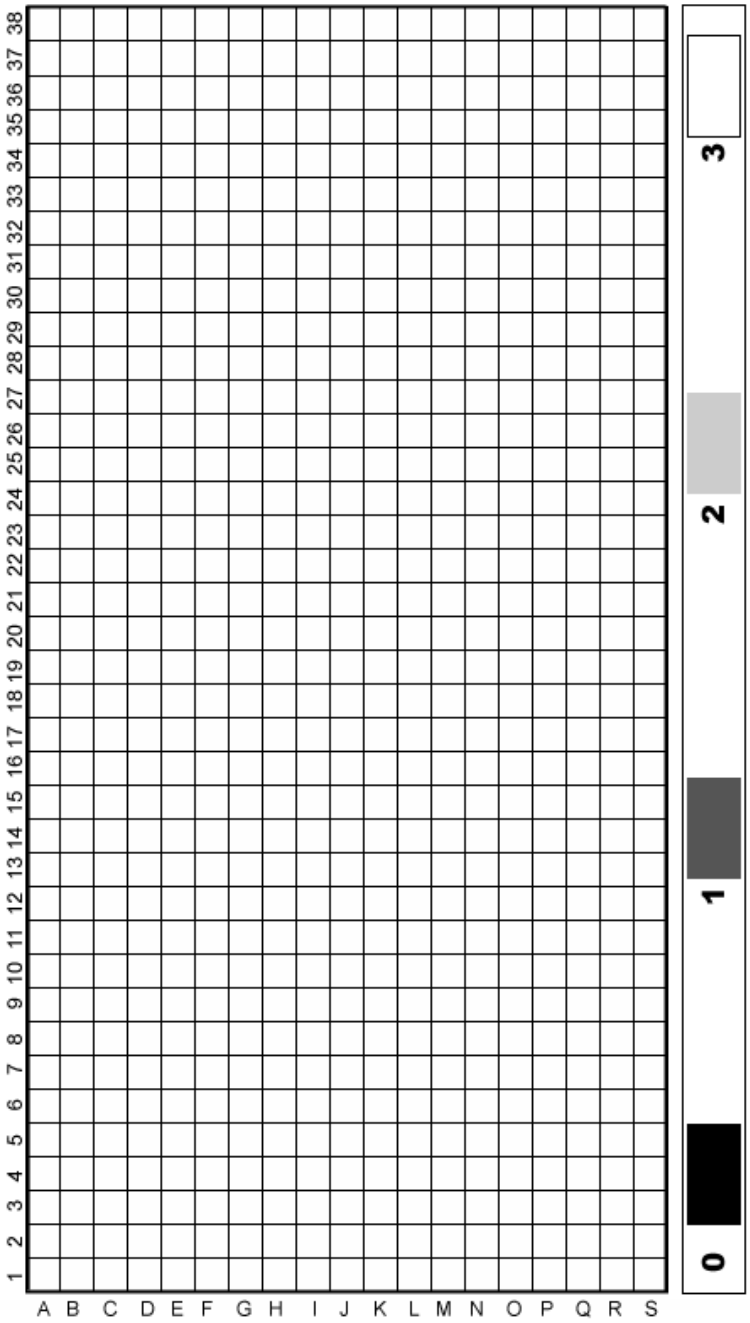
Procedure:
1. Divide into pairs.
2. Decide who will act as the telescope (student A), and who will act as the computer (student B). Student A should receive pg. 28 and student B should receive pg. 29.
3. Student A: From your teacher, get the transparent grid that has been prepared resembling the grid on pg. 29.
4. Student A: Place the transparent grid over the picture on pg. 28.
5. Student A: You, as the telescope, will be telling the computer (Student B) what to record on the grid. Using the shaded boxes, assign a shade (0-3) to each box. For example box A,1 will be 0.
6. Student B: Color each Box according to the shade assigned by student A.
7. Continue until all boxes in the grid are colored.

Conclusion:
What did you learn from this exercise? How do computers and scientists work together?

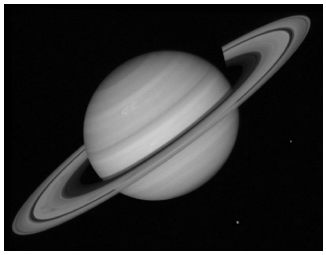
Name_____

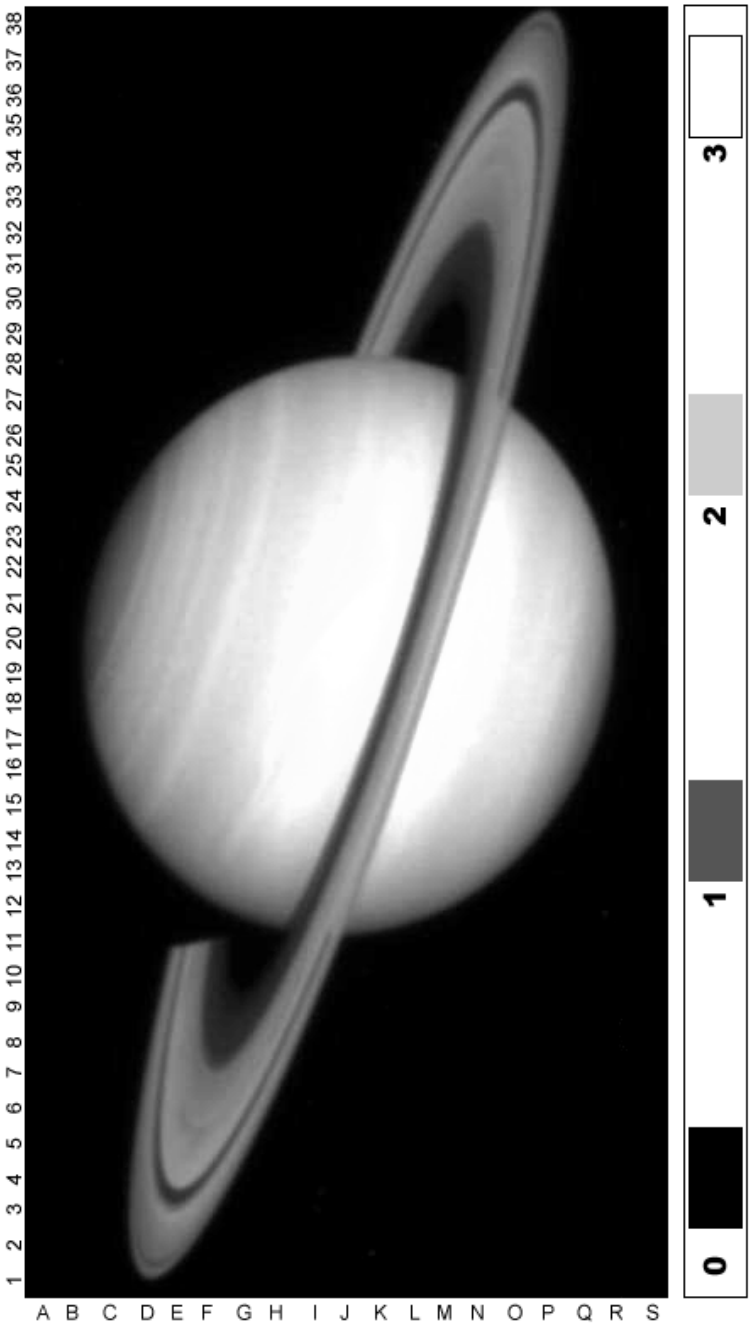


Planet by Numbers (cont.)

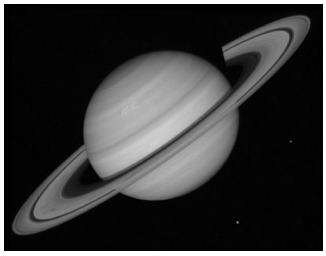


Name_____




1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38
A B C D E F G H I J K L M N O P Q R S
0
1
2
3

Name_____



Vocabulary of *The Outer Planets*

___1) olput _____

___2) craenul snoifu _____

___3) nnrei ntlapes _____

___4) ptrejiu _____

___5) netpenu _____

___6) raoitsde tleb _____

___7) roeut ntlapes _____

___8) uanrsu _____

___9) ghdneyor _____

___10) tanrsu _____

a. the four closest planets to the sun

b. the five planets located farthest from the sun

c. the process by which energy is produced in the sun

d. the primary source of fuel in the sun

e. concentration of asteroids located between Mars and Jupiter

f. the planet containing a storm which appears as a giant red spot

g. the second largest planet; possesses large, beautiful rings

h. the planet that appears to lie on its side due to the fact that it is tilted at 90 degrees

i. the farthest planet from the sun

j. the eighth planet from the sun